Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

American Woods September 1945

Elm

Forest Service
U. S. DEPARTMENT OF AGRICULTURE

ELM

(*Ulmus species*)

By H. S. Betts, *senior engineer, Division of Forest Products*

The six species of elm which grow in the United States are American elm, slippery elm, rock elm, winged elm, cedar elm, and September elm. Of these, American elm is the best known because of its great beauty and dignity. It is the largest of the elms, sometimes reaching a height of 100 feet and a diameter of 6 feet. American elm has been planted as a shade tree on streets, roadsides, and home sites throughout practically the entire United States and is especially identified with the towns and countrysides of southern New England, New York, and the North Central States.[1]

In typical open-grown American elms, the branches into which the trunk divides 20 to 30 feet above the ground sweep upward, outward, and then downward in a graceful curve not unlike the spray of a fountain. The spread of the branches may be as much as 150 feet. Forest-grown trees which are more or less crowded by other trees are usually columnar and undivided to a height of 30 to 60 feet or more.

As a source of lumber American elm, commonly known as white elm in the lumber trade, is by far the most important species. Considerable amounts of lumber are also cut from slippery elm and rock elm. Winged elm, cedar elm, and September elm are of comparatively little commercial importance. Limited quantities of cedar elm lumber are cut and marketed as "southern rock elm."

American elm and slippery elm both grow throughout nearly all of the United States east of the Rocky Mountains. The other species also grow in the eastern part of the United States, but their ranges are much more limited. The growth of the elms as a whole is rather rapid.

Elm is a valuable wood for special purposes on account of its combination of excellent bending qualities, ability to withstand rough usage, and strength. These properties make it particularly valuable for slack cooperage, basket rims and handles, bent work in vehicles and chairs, and framework of furniture.

Elm is becoming scarcer, but under normal conditions a fairly constant although probably diminishing supply is assured for a long time because of the wide range of the different species and the fact that they still form an appreciable percentage of the mixed hardwood stands in the eastern United States.

Nearly 20 years ago the elm trees in the vicinity of New York City were attacked by a fungous disease, known as the "Dutch elm disease," which was introduced through the medium of burl elm veneer logs imported from Europe during the years 1926–33. Not until 1933 was it discovered how the disease was introduced and measures were taken to stop further imports of elm logs and other materials under suspicion. Infected trees are being cut and destroyed in an effort to check the spread of the disease, which is carried on the bodies of flying beetles. The most heavily infected areas are those surrounding New York City. These extend into New York State, Connecticut, and New Jersey. Localized infected areas have been found as far west as Indianapolis, Ind., and as far south as Norfolk, Va. ' Although good progress has been made in the eradication work, the outcome is as yet in doubt. Unless the disease is checked, it will continue to spread,[2] and elm, both as a source of wood for industrial purposes and as a shade tree, will be endangered throughout its range and wherever it has been planted in North America.

---

[1] AMERICAN FORESTRY ASSOCIATION. THE AMERICAN ELM. 32 pp., illus. Washington, D. C. [1937.] This booklet contains the numbers of officially reported elms within the metropolitan areas of a few representative cities. The city of Minneapolis, Minn., alone reports approximately 600,000 elm shade trees. Other cities which report large numbers of elms include Detroit, Mich., 400,000; Dallas, Tex., 300,000; Denver, Colo., 100,000; Sacramento, Calif., 12,500.

Nomenclature.—The names of the six species of elm used in commercial quantities are as follows:

Common name	Botanical name	Other names
American elm	*Ulmus americana*	White elm, water elm, grey elm, Canadian elm, swamp elm.
Slippery elm	*Ulmus fulva*	Red elm.
Rock elm	*Ulmus thomasii*	Cork elm, hickory elm.
Winged elm	*Ulmus alata*	Wahoo.
Cedar elm	*Ulmus crassifolia*	Red elm, basket elm.
September elm	*Ulmus serotina*	Red elm.

Distribution and growth.—American elm has the widest range of growth of any of the elms. It grows from Newfoundland across Canada to the Rocky Mountains, and southward throughout the entire eastern United States except southern Florida (fig. 1). The areas of greatest commercial importance are the Lake States and the southern Mississippi Valley. Slippery elm grows in nearly the same territory as American elm but has not quite so wide a range (fig. 2). Rock elm, frequently called cork elm,[3] grows from New Hampshire to Nebraska and as far south as Tennessee (fig. 3). A large proportion of the commercially important rock elm is located in Wisconsin and Michigan. Winged elm, cedar elm, and September elm grow in southeastern United States—winged elm chiefly in Missouri, Arkansas, and southeastern Texas(fig. 4); cedar elm chiefly in Arkansas and Texas (fig. 5); and September elm, so far as known, chiefly in Tennessee and Arkansas.

American elm grows best on moist bottom lands and along the borders of streams. Under such conditions 20-year-old forest-grown trees reach an average diameter of 4½ inches and an average height of 31 feet. At 50 years the diameter and height will average about 10 inches and 51 feet, respectively. American elm attains an age of 200 years and sometimes more. Large quantities of seed mature early in the season. They are provided with a membrane or "wing" which insures wide distribution by the wind. American elm reproduces from stump sprouts as well as from seed. Slippery elm, like American elm, prefers moist locations but is also found on rocky ridges and slopes. Rock elm has less exacting moisture requirements than either American or slippery elm.

---

[2] The chestnut blight is an example of a tree disease which could not be checked and which is resulting in the eradication of chestnut in this country.

[3] The name cork elm is derived from the corky growths on the twigs.

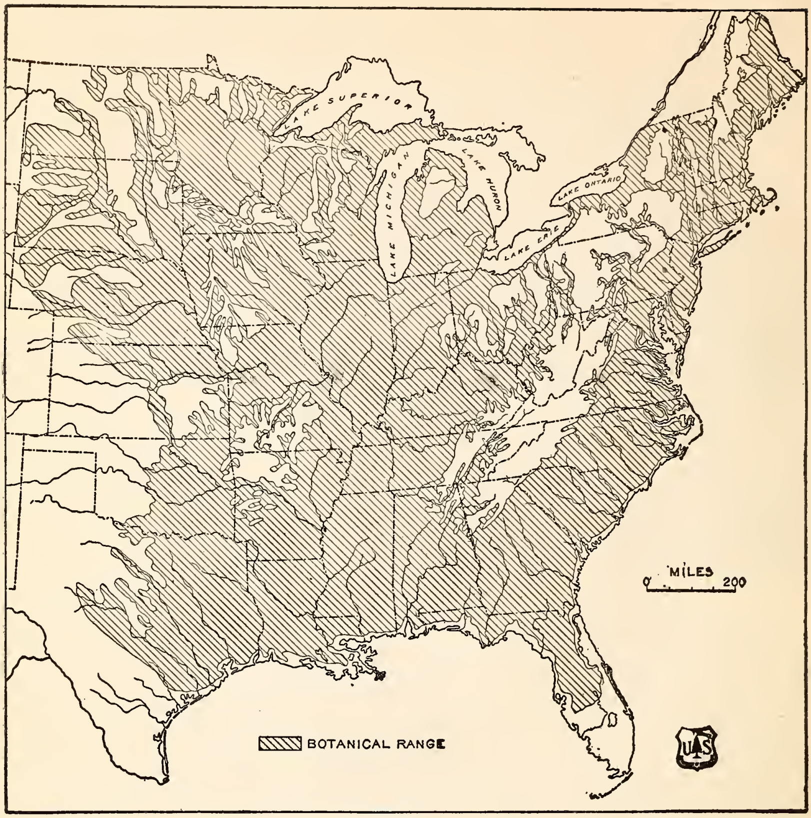

FIGURE 1.—Range of American elm (*Ulmus americana*) in the United States.

Supply.—The stand of elm of saw-timber size in the United States is roughly estimated in round figures at 8,000,000,000 board feet, made up as follows:

		Board feet[1]
Lake States:		
Minnesota	701, 690, 000	
Wisconsin	1, 227, 900, 000	
Michigan	1, 247, 740, 000	
		[2] 3, 177, 330, 000
Mississippi Delta region[3]		[4] 2, 658, 600, 000
Remainder of elm range including the Central States, Northeastern States, and Southern States except the Mississippi Delta region		[5] 2, 150, 000, 000
Total		7, 985, 930, 000

---

[1] International ¼-inch rule.

[2] CUNNINGHAM R. N., and MOSER, H. C. FOREST AREAS AND TIMBER VOLUMES IN THE LAKE STATES. U. S. Forest Serv., Lake States Forest Expt. Sta. Rpt., 84 pp., illus. 1938.

[3] Includes portions of Louisiana, Arkansas, and Mississippi.

[4] Based on forest surveys of the Southern States conducted by the Southern Forest Experiment Station during the period 1934–38.

[5] A rough estimate based on the relative size of the remainder of the range of elm. This estimate is, of course, subject to change as more definite information on the stand of elm in the area in question becomes available.

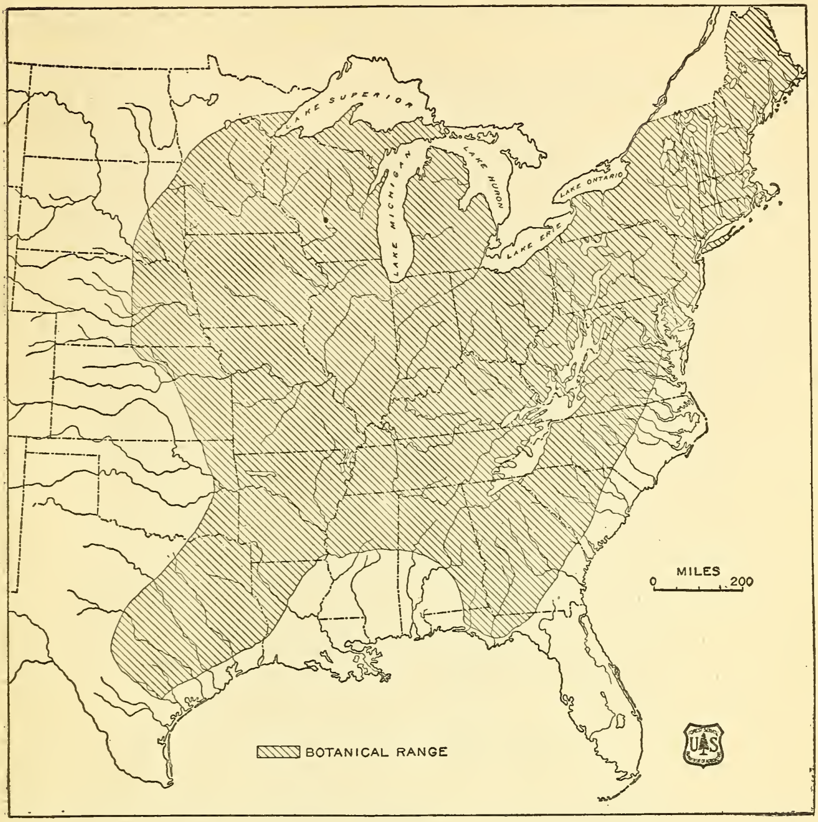

Figure 2.—Range of slippery elm (*Ulmus fulva*).

The States which have the largest stands of elm include Wisconsin, Michigan, Louisiana, Arkansas, Ohio, and Indiana.

Production of lumber.—The maximum reported cut of elm lumber (457,739,000 board feet) occurred in 1899—the first year for which statistics for elm lumber were recorded separately from other species (fig. 6). Since then production has decreased irregularly, dropping to a minimum of 20,169,000 board feet in 1932. By 1942 production had increased to 167,153,000 board feet reported by 34 States. The average annual cut of elm lumber for the 10-year period 1933–42 was approximately 84,000,000 board feet. Michigan was the leading State in elm lumber production in 1899 and 1904. Since then Wisconsin has been first and Michigan second.[4] In recent years the States ranking third have generally been Louisiana, Arkansas, or Ohio. In 1942 the four leading States were Wisconsin, Ohio, Michigan, and Mississippi. Wisconsin, Ohio, and Michigan furnished about 37 percent of the elm lumber produced in that year. 1943 production was 158,025,000 board feet.

---

[4] Except in 1912 and 1940 when Michigan was first and Wisconsin second, in 1933 Wisconsin was first and Louisiana second, in 1941 Ohio was first and Wisconsin second, and in 1942 Wisconsin was first and Ohio second.

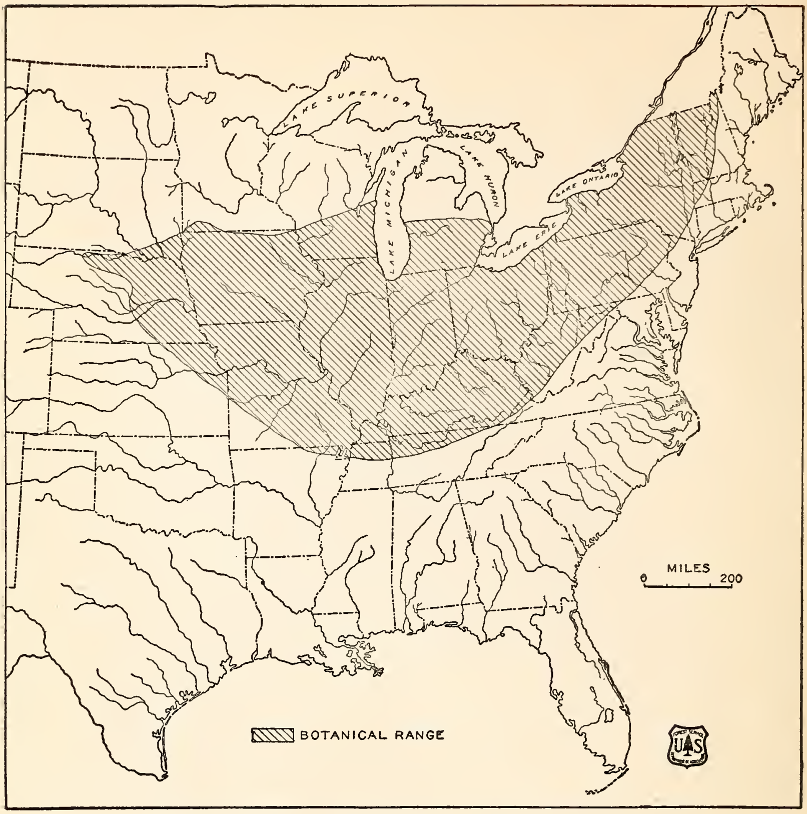

FIGURE 3.—Range of rock elm (*Ulmus thomasii*)

Veneer.—The amount of elm used for veneer has varied from a minimum of 5,544,000 feet log scale in 1905 [5] to a maximum of 20,937,000 feet log scale in 1931.[6] The average annual consumption of elm for veneer in recent years [7] has been 17,320,000 feet log scale equivalent to approximately 20,000,000 board feet.[8]

Cooperage.—In 1906 [9] about 248,000,000 elm slack staves were produced and about 19,000,000 sets of elm slack heading.[10] Since 1906 there has been a marked reduction in the amount of elm used for cooperage purposes. In 1939 [11] only 36,000,000 elm slack staves were produced and only 7,000 sets of slack heading. The average annual production of elm slack staves and heading in recent years has been about 36,500,000 staves[12] and 28,000 sets of heading equivalent to approximately 12,000,000 board feet.[13]

---

[5] The earliest year for which statistics on elm veneer are available.

[6] This was a year of depression in business, and it is unusual for a maximum to occur under such conditions.

[7] Years averaged 1927, 1929, 1931, 1935, and 1937. The latest consumption figures for elm veneer are those for 1937.

[8] Overrun in log scale is considered to be 15 percent.

[9] The first year for which cooperage statistics on elm are available.

[10] The amount of elm used for tight cooperage is small and is not recorded separately from a number of other species.

[11] The last year for which cooperage statistics on elm are available.

The average annual production of elm for all purposes in recent years, including all species, is estimated roughly at 125,000,000 board feet.

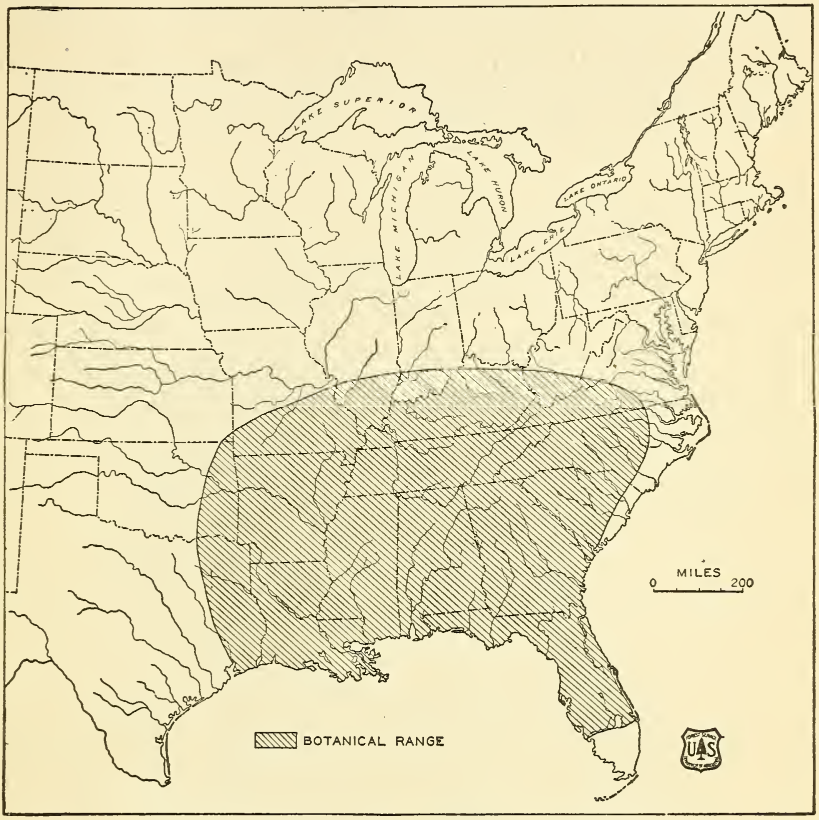

FIGURE 4.—Range of winged elm (*Ulmus alata*).

Properties.—The heartwood of elm is light brown often tinged with red and the sapwood nearly white. The annual rings in American elm and slippery elm are distinctly marked with one or more rows of readily visible pores which occur in the springwood[14] and give a pleasing figure in plain sawed lumber.[15] In rock elm the pores in the springwood are comparatively small and barely visible without a lens. In American elm the sapwood is generally from 1 to 3 inches wide, in rock elm from ¾ to 1½ inches wide, and in slippery elm generally less than ½-inch wide.

---

[12] Years averaged: 1935, 1937, and 1939.

[13] Three slack staves are considered equivalent to 1 board foot and one set of heading to 2 board feet.

[14] Each annual ring in the cross section of a tree is made up of a band of springwood, generally comparatively soft and light in color, and a band of darker, harder summerwood formed towards the end of the growing season.

[15] In plain (flat) sawed lumber the wide surfaces are approximately tangential to the annual rings. In quarter-sawed lumber the wide surfaces are approximately perpendicular to the annual rings.

American elm and slippery elm are moderately heavy woods with a large shrinkage in drying. They have a high degree of shock-resisting ability,[16] and are moderately hard and stiff. Slippery elm rates as "strong" and American elm as "moderately weak." All of the three commercial elms have excellent bending qualities. Rock elm is somewhat heavier than American elm, and slippery elm ranks above them in strength, hardness, and shock-resisting ability. It also has a large shrinkage in drying. Rock elm is close to white oak in strength and hardness and superior to white oak in ability to resist shock. American elm and rock elm are difficult to split. American, slippery, and rock elm are only moderately resistant to decay—considerably less so than white oak. Rock elm and slippery elm are considered slightly more resistant to decay than American elm. Slippery elm is classed with the woods easy to penetrate with a preservative, while rock elm is classed with the woods difficult to penetrate. The elms require care in drying because of their tendency to warp and twist. American elm and slippery elm are commonly marketed as "soft elm." Dense material of these species is sometimes sold as "rock elm" and used for

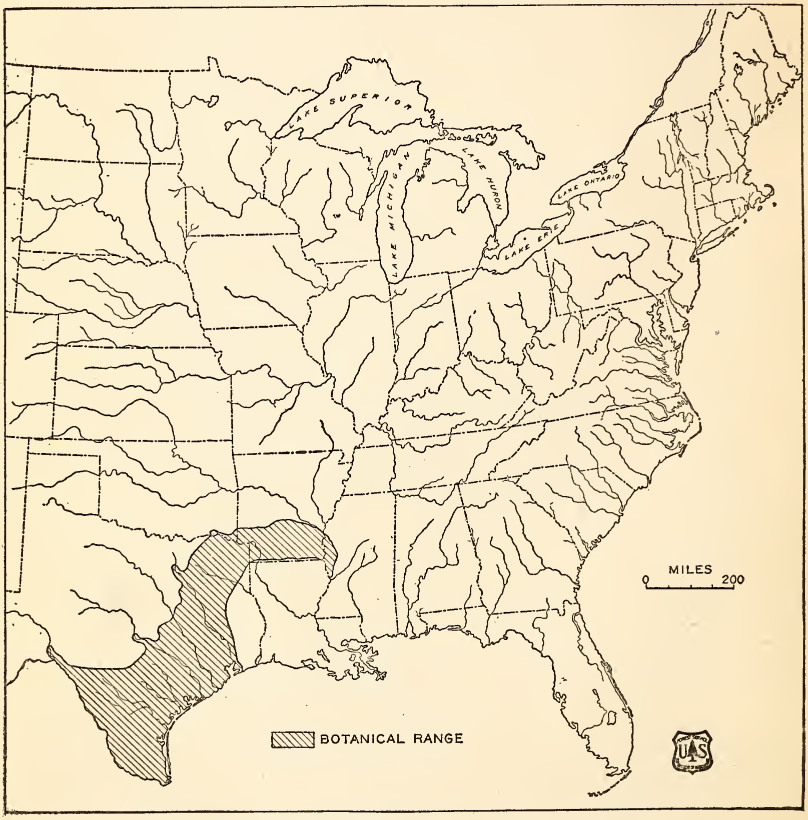

FIGURE 5.—Range of cedar elm (*Ulmus crassifolia*).

---

[16] Slippery elm rates somewhat above American elm in this respect.

the same purposes as rock elm. Tests to determine the strength properties of cedar elm, winged elm, and September elm have not been made. Specific gravity determinations on a few samples of cedar elm indicate that in weight and strength properties it is more like rock elm than American or slippery elm.

Principal uses.—Elm lumber is used principally in the manufacture of containers such as boxes, baskets, crates, cheese boxes, and slack barrels; furniture (including chairs); dairy, poultry, and apiary supplies; caskets and burial boxes; and vehicle parts. For many of these uses the different species of elm are employed indiscriminately. For others, where hardness or ability to resist shock is required to a high degree, rock elm is preferred.

The principal use of elm in the past has been in the manufacture of slack-cooperage staves sliced directly from the logs. Elm was also formerly much used for the hoops of slack barrels, but has been displaced by metal hoops. In 1923 about one-quarter of the total cut of elm was used in the cooperage industry. In 1910 over one-third of the total went into cooperage, and still earlier elm was used in greater quantities for slack cooperage than any other wood. It is still considered superior to other woods commonly used as slack-stave material but is now outranked in production by a number of species.

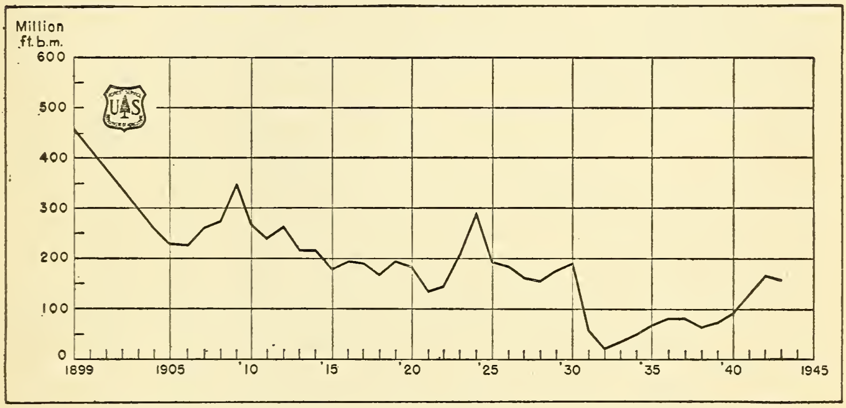

Figure 6.—Lumber production of elm (*Ulmus* species), 1899–1943.

Elm veneer is used in considerable quantities for fruit and vegetable boxes and baskets and for round cheese boxes. Its strength, toughness, and bending properties make it very serviceable for certain types of containers that must stand rough usage, such as market baskets, and bushel and half-bushel baskets for home use. It is much used for crating heavy articles such as furniture and bulky material, glass, and porcelain products.

Although wood has been largely replaced by steel in motor vehicles, appreciable amounts of elm still go into their construction. It is a valuable wood for carriages and wagons, but the aggregate used for such products is now small. Elm continues to be used in considerable amounts for furniture, especially the bent parts of chairs such as rockers and arms. It is also used in kitchen cabinets and kitchen tables but not in such quantities as formerly.

In the case of agricultural implements, toys, sporting and athletic goods, handles, and laundry appliances the use of metal (as, for instance, in washing machines) has been largely responsible for the decrease in the use of elm. In the old-style trunk the slats on the outside and the framework were usually of elm. This has been replaced by the fiber trunk. Considerable amounts of elm were formerly used for the framework of pianos and organs.

The thick, mucilaginous inner bark of slippery elm is often used for chewing purposes in the same way as spruce gum. It has been used as a constituent of throat lozenges.

Table 1 shows the amounts of elm used by factories in the manufacture of different classes of products in 1912, 1928, 1933, and 1940. The table includes elm in the form of lumber with much smaller amounts of logs and bolts, and veneer.

TABLE 1.—*Elm used in the manufacture of wooden products*

[Thousands of board feet]

Classes of products	1912	1928	1933	1940
Airplanes	----------	1	----------	----------
Agricultural implements	7, 249	2, 112	84	257
Boot and shoe findings	2	----------	----------	----------
Boxes, baskets and crating	63, 726	48, 014	[1] 37, 645	[1] 48, 838
Boxes, cigar and tobacco	1, 809	131	----------	----------
Car construction and repair	1, 221	675	316	20
Caskets and burial boxes	----------	26	----------	4, 078
Conduits, pumps, and wood pipe	20	----------	----------	4
Dairy, poultry, and apiary supplies	(2)	600	2, 843	5, 338
Dowels and skewers	[3] 175	[3] 46	----------	----------
Electrical equipment	463	----------	----------	----------
Fixtures	6, 368	583	145	1, 169
Furniture	35, 312	27, 841	9, 896	18, 878
Handles	3, 247	275	109	137
Instruments, musical	15, 602	328	100	692
Instruments, professional and scientific	1	2	----------	39
Ladders	(2)	(2)	2	----------
Laundry appliances	1, 365	67	50	137
Machinery	1, 109	1	----------	31
Patterns and flasks	40	700	100	110
Playground equipment	334	75	151	----------
Plumbers' woodwork	55	----------	----------	----------
Printing material	84	150	----------	----------
Refrigerators	[4] 13, 046	[4] 5, 954	387	173
Rollers, shade and map	----------	----------	----------	108
Sash, doors, general millwork	[5] 6, 417	[5] 2, 651	[6] 33	[6] 320
Sewing machines	----------	204	----------	----------
Ship and boat building	707	64	2	1
Signs, scenery, displays	200	----------	----------	21
Sporting and athletic goods	3, 227	908	349	396
Tanks	15	----------	----------	----------
Toys	2, 042	949	273	517
Trunks and valises	6, 409	50	8	----------
Vehicles, motor	(7)	71, 596	10, 753	2, 177
Vehicles, nonmotor	31, 297	824	356	905
Woodenware and novelties	16, 659	1, 309	849	1, 338
Total	218, 201	166, 136	64, 451	[8] 85, 684

---

[1] Figures for 1933 and 1940 include elm used for boxes and crates by plants not classified as manufacturers of wooden products and which were not included in 1912 and 1928. The amounts included for nonmanufacturers of wooden products were as follows: For 1933—3,449,000 board feet and for 1940—13,792,000 board feet.

[2] Included in "Woodenware and novelties."

[3] Includes dowels only.

[4] Includes kitchen cabinets.

[5] Includes planing-mill products such as siding, flooring, ceiling, etc.

[6] Planing-mill products not included in 1933 and 1940 canvasses except flooring which is listed separately.

[7] Included in "Vehicles, nonmotor."

[8] This total includes 71,435,000 board feet of lumber, 8,983,000 board feet of logs and bolts, and 5,266,000 board feet of veneer.

REFERENCES

AMERICAN FOREST TREES. H. H. Gibson. 708 pp., illus. Chicago. 1913.

GUIDEBOOK FOR IDENTIFICATION OF WOODS USED FOR TIES AND TIMBERS. A. Koehler. U. S. Dept. Agr. Unnum. Pub., 79 pp., illus. 1917.

HANDBOOK OF THE TREES OF THE NORTHERN STATES AND CANADA EAST OF THE ROCKY MOUNTAINS. R. B. Hough. 470 pp., illus. 1907.

LUMBER USED IN MANUFACTURE—1928, 1933, AND 1940. (Summary tables.) U. S. Forest Service Preliminary Statistics—Forest Survey of the United States.

LUMBER USED IN THE MANUFACTURE OF WOODEN PRODUCTS. J. C. Nellis. U. S. Dept. Agr. Bul. 605, 18 pp., illus. 1918.

MANUAL ON PRESERVATIVE TREATMENT OF WOOD BY PRESSURE. J. D. McLean. U. S. Dept. Agr. Misc. Pub. 224, 124 pp., illus. 1935.

THE SOUTHERN HARDWOODS—ELM. Southern Hardwood Producers, Inc. South. Lumberman 162 (2041) : 28 pp., illus. 1941.

STRENGTH AND RELATED PROPERTIES OF WOODS GROWN IN THE UNITED STATES. L. J. Markwardt and T. R. C. Wilson. U. S. Dept. Agr. Tech. Bul. 479, 99 pp., illus. 1935.

UTILIZATION OF ELM. W. D. Brush. U. S. Dept. Agr. Bul. 683, 43 pp., illus. 1918.

U. S. GOVERNMENT PRINTING OFFICE: 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 5 cents